WHAT IS CLAIMED IS:

1. A method for producing an image indicative of temperature change in a sample positioned in an MR imaging system, the steps comprising:

performing an NMR pulse sequence;

measuring the signal phase shift;

correlating the signal phase shift with a temperature change; and

constructing a temperature map.

2. The method of claim 1 wherein measuring the signal phase shift is further comprised of measuring the change in the resonance frequency of the water proton.

3. The method of claim 2 wherein measuring the signal phase shift is further comprised of correlating the change in the resonance frequency of the water proton to a change in temperature.

4. The method of claim 3 wherein the temperature map is method for constructing a temperature map further comprises:

acquiring a first k-space line in a first plane;

acquiring a second k-space line in a second plane; and

acquiring a third k-space line in a third plane.

5. The method of claim 4 wherein the image acquisition sequence follows as such:

A(1),B(1),C(1),A(2),B(2),C(2),.....,A(25),B(25),C(25),.....,A(256),B(256),

C(256)

in which P(i) denotes the i'th k-space line in plane P.

6. The method of claim 5 wherein a scan is performed by repeating the steps of claim 5 to produce a corresponding plurality of additional temperature maps.

7. The method of claim 6 including the step of periodically updating the temperature map.

8. The method of claim 7 in which the NMR pulse sequences are RF-spoiled gradient echo pulse sequences.

9. The method of claim 8 in which a contrast agent is used in the sample.

10. The method of claim 9 wherein the contrast agent used is Gd-DPTA.

11. A method for producing an image indicative of temperature change in a sample positioned in an MR imaging system, the steps comprising:

performing an NMR pulse sequence to acquire phase reference images from the sample;

constructing a reference phase image from the sample;

performing an NMR pulse sequence to acquire measurement NMR data from the sample;

measuring the signal phase shift; and

producing a temperature map based on the difference phase differences.

12. The method of claim 11 wherein the measurement NMR data is comprised of a plurality of k-space points.

13. The method of claim 12 wherein the measurement of NMR data is comprises the steps of:

acquiring a first k-space line from a series of k-space points in a first k-space plane;

acquiring a second k-space line from a series of k-space points in a second k-space plane; and

acquiring a third k-space line from a series of k-space points in a third k-space plane.

14. The method of claim 13 wherein the image acquisition sequence follows as such:

A(1),B(1),C(1),A(2),B(2),C(2),.....,A(25),B(25),C(25),.....,A(256),B(256),

C(256)

in which P(i) denotes the i'th k-space line in plane P.

15. The method of claim 14 which further includes periodically updating the reference phase image using measurement NMR data acquired during the scan.

16. The method of claim 15 which further includes the step of repeating the steps of claim 11 so as to provide a plurality of additional temperature maps.

17. The method of claim 16 wherein measuring the signal phase shift is further comprised of measuring the change in the resonance frequency of the water proton.

18. The method of claim 17 wherein measuring the signal phase shift is further comprised of correlating the change in the resonance frequency of the water proton to a change in temperature.

19. The method of claim 18 in which a contrast agent is used in the sample.

20. The method of claim 19 wherein the contrast agent used is Gd-DPTA.

21. The method of claim 20 in which the NMR pulse sequences are RF-spoiled gradient echo pulse sequences.

22. A method for producing an image indicative of temperature change in a sample positioned in an MR imaging system wherein the MR imaging system acquires data from a plurality of k-space points, the steps comprising:

performing an NMR pulse sequence to acquire phase reference images from the sample;

constructing a reference phase image from the sample;

performing an NMR pulse sequence to acquire measurement NMR data including the steps of;

(a) acquiring a first k-space line from a series of k-space points in a first k-space plane;

(b) acquiring a second k-space line from a series of k-space points in a second k-space plane; and

(c) acquiring a third k-space line from a series of k-space points in a third k-space plane.

measuring the signal phase shift; and

producing a temperature map based on the difference phase differences.

23. The method as recited in claim 22 which further includes periodically updating the reference phase image using measurement NMR data acquired during the scan.

24. The method as recited in claim 23 which further includes the step of repeating the steps of claim 11 so as to provide a plurality of additional temperature maps.

25. The method as recited in claim 24 wherein measuring the signal phase shift is further comprised of measuring the change in the resonance frequency of the water proton.

26. The method as recited in claim 25 wherein measuring the signal phase shift is further comprised of correlating the change in the resonance frequency of the water proton to a change in temperature.

27. The method as recited in claim 26 wherein the image acquisition sequence follows as such:

A(1),B(1),C(1),A(2),B(2),C(2),.....,A(25),B(25),C(25),.....,A(256),B(256),

C(256)

in which P(i) denotes the i'th k-space line in plane P.

28. The method as recited in claim 27 in which the NMR pulse sequences are RF-spoiled gradient echo pulse sequences.